Planetesimal Evolution and Terrestrial Planet Formation

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We will present the results of our most recent numerical simulations of terrestrial planet formation. We have developed the most realistic planetesimal collision model to date that handles accretion and erosion of planetesimals in a self-consistent manner. In our collision model gravity is the dominant mechanism in determining the collision outcome. We have fully integrated our collision model into a direct, parallelized, hierarchical, *N*-body code, called `pkdgrav` (Richardson *et al.* 2000, Stadel 2001) in order to study terrestrial planet formation in detail. We have run several numerical simulations with our collision model using similar initial conditions to previous numerical simulations (Kokubo and Ida 1998, 2000, 2002), allowing a straightforward basis for comparison. We have found that our "dust" component—the particles that are below our resolution limit—is potentially dynamically important, as suggested by Goldreich, Lithwick, and Sari (2004). We have also found that the general outcome of our simulations depends strongly on the initial conditions of the planetesimal disk and the collision model but is effectively independent of the coefficient of restitution of the planetesimals. In order to achieve higher resolution we will submit a large (10^6-particle) simulation to the Pittsburgh Supercomputer Center.